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EXAMINER

CHANDRA, SATISH

ART UNIT

PAPER NUMBER

1792

MAIL DATE

DELIVERY MODE

03/06/2008

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/823,347

Applicant(s)

CHOI ET AL.

Examiner

SATISH CHANDRA

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1792

Period for Reply -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 January 2008.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 23 - 48 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 23 - 48 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 April 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-85/86)
- Paper No(s)/Mail Date 8/04 and 1/06.

- 4) ☐ Interview Summary (PTO-413)
- Paper No(s)/Mail Date _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 23 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hamelin et al (US 2006/0134919) in view of Cain et al (US 5,439,524) and Chinn et al (US 2003/0124848).

Hamelin et al discloses:

Regarding claims 23 and 36, a distribution plate 430 (Fig 9B) comprising: a plurality of gas passages 446 passing between the upstream and downstream sides, wherein at least one of the gas passages has a first right cylindrical shape for a portion of its length extending from the upstream side, a second coaxial cylindrical shape with a smaller diameter connected to the first cylindrical shape, a coaxial conical shape 444 connected to the second cylindrical shape for the remaining length of the diffuser plate, with the upstream end of the conical portion having substantially the same diameter as the second cylindrical shape and the downstream end of the conical portion having a larger diameter.

Hamelin et al does not disclose:

Regarding claims 23 and 36, an RF source coupled to the diffuser plate.

Cain et al discloses: a plasma processing apparatus wherein an RF power source is coupled to the diffuser plate.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide an RF source to the diffuser plate in the apparatus of Hamelin et al as taught by Cain et al. It would have been obvious to a skilled artisan to combine prior art elements to yield predictable results such as providing an RF source connected to the distributor plate in the apparatus of Hamelin et al as taught by Cain et al.

The motivation for providing an RF source connected to the distributor plate is to optimize the apparatus of Hamelin et al for producing plasma in the apparatus of Hamelin et al as taught by Cain et al.

Hamelin et al and Cain et al do not disclose:

Regarding claim 36, plasma process chamber coupled to a remote plasma source and the remote plasma source is coupled to a fluorine source.

Chinn et al discloses:

Regarding claim 36, a fluorine source (NF₃) coupled to a remote plasma generator 710 (Fig 7, Para 0037) which is coupled to the processing chamber 724.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide a remote plasma generator coupled to a fluorine source and to the processing chamber in the apparatus of Hamelin et al and Cain et al

as taught by Chinn et al. It would have been obvious to a skilled artisan to combine prior art elements to yield predictable results such as providing a remote plasma generator coupled to a fluorine source and to the processing chamber in the apparatus of Hamelin et al and Cain et al as taught by Chinn et al.

The motivation for providing a remote plasma generator coupled to a fluorine source and to the processing chamber in the apparatus of Hamelin et al is to provide fluorine radicals for etching and cleaning purposes.

Claims 24 – 31, 33, 35, 37 - 44, 46 and 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hamelin et al (US 2006/0134919) in view of Cain et al (US 5,439,524) and Chinn et al (US 2003/0124848) as discussed in claims 23 and 36 above and further in view of Metzner et al (US6,454,860).

Hamelin et al, Cain et al and Chinn et al do not disclose:

Regarding claims 24 and 37, the diameter of the portion having the first cylindrical shape is between about 0.06 inch to about 0.3 inch.

Regarding claims 25 and 38, the diameter of the portion having the second cylindrical shape is between about 0.030 inch to about 0.070 inch.

Regarding claims 27 and 40, the diameter of the downstream end of the conical portion having the conical shape between about 0.2 inch to about 0.4 inch.

Regarding claims 29 and 42, the ratio of the length of the portion having the second cylindrical shape to the length of the portion having the conical shape between about 0.8 to about 2.0.

Regarding claims 30 and 43, the spacing between the downstream end of the conical portion of adjacent gas passages is at most about 0.5 inch.

Regarding claims 31 and 44, the thickness of the diffuser plate is between about 1.0 inch to about 2.2 inches.

Metzner et al discloses:

Regarding claims 24 and 37, the diameter of the first cylindrical shape 247 is 0.11 inch (Fig 9, Col 11, line 6).

Regarding claims 25 and 38, the diameter of the second cylindrical shape 286 is 0.08 inch (Fig 9, Col 11, line 17).

Regarding claims 26 and 39, the ratio of the length of the first right cylindrical shape to the length of the second cylindrical shape is about 1.37 (ratio of 0.11 to 0.08).

Regarding claims 27 and 40, the diameter of the downstream end 288 of the conical portion is 0.213 inch (Column 11, line 55).

Regarding claims 29 and 42, the ratio of the length (0.028 inch) of the second cylindrical shape 286 (Fig 9) to the length 255 (0.1021 inch) of the conical shape is between 0.8 to about 2.0 (Columns 11 and 12).

Regarding claims 30 and 43, the spacing 261 (Fig 9) between the downstream end of the conical portion of adjacent gas passages is 0.005 inch (Column 13, lines 2-4).

Regarding claims 31 and 44, the thickness of the diffuser plate is 0.4 inch (Column 12, line 14).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the diameter of the first cylindrical shape about 0.11 inch, diameter of the second cylindrical shape of 0.08 inch, the diameter of the downstream end of the conical portion of 0.213 inch, the ratio of the length of the second cylindrical shape to the length of the conical shape between 0.8 to about 2.0, the spacing between the downstream end of the conical portion of the adjacent gas passage of 0.005 inch and a diffuser plate of thickness 0.4 inch in the apparatus of Hamelin et al, Cain et al and Chinn et al as taught by Metzner.

It would also have been obvious to one of ordinary skill in the art at the time the invention was made to provide a diffuser plate of appropriate thickness between about 1.0 inch to about 2.2 inches in the apparatus of Hamelin et al, Cain et al, Chinn et al and Metzner et al.

The motivation for providing the diameter of the first cylindrical shape about 0.11 inch, diameter of the second cylindrical shape of 0.08 inch, the diameter of the downstream end of the conical portion of 0.213 inch, the ratio of the length of the second cylindrical shape to the length of the conical shape between 0.8 to about 2.0, the spacing between the downstream end of the conical portion of the adjacent gas passage of 0.005 inch and a diffuser plate of thickness 0.4 inch in the apparatus of Hamelin et al is to optimize the distribution plate of Hamelin et al for distributing a uniform gas flow inside the chamber.

The motivation for providing a diffuser plate of thickness between about 1.0 inch to about 2.2 inches in the apparatus of Hamelin et al, Cain et al, Chinn et al and

Metzner et al is to provide a diffuser plate of desired thickness to withstand high chamber pressures in the apparatus of Hamelin et al, Cain et al, Chinn et al and Metzner et al. Further it has been held where the only difference between the prior art and the claims is a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device is not patentably distinct from the prior art device. In Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984).

Hamelin et al, Cain et al, Chinn et al and Metzner et al do not disclose:

Regarding claims 28 and 41, the conical shape is flared at about 20 degrees to about 35 degrees.

Regarding claims 33 and 46, the cylindrical shape formed through the diffuser plate have a flow restricting attribute different than the coaxial flared shape.

Regarding claims 35 and 48, the gas diffuser plate size is at least 1080 inch².

The angle, aperture length ratios and their diameters and size of the diffuser plate in a processing chamber are the obvious design limitations. One of ordinary skill in the art would be able to optimize the angle, aperture length ratios and aperture diameters. Furthermore, it was held where the only difference between the prior art and the claims is a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device is not patentably distinct from the prior art device. In Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert.

denied, 469 U.S. 830, 225 USPQ 232 (1984) and It was also held in *re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966) that the shape was a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular shape was significant. (Also see MPEP 2144.04(d)).

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to optimize the angle, aperture length ratios, aperture diameters and the size of the distributor plate in the apparatus of Hamelin et al, Cain et al, Chinn et al and Metzner et al.

It would also have been obvious to one of ordinary skill in the art at the time the invention was made to have a flow restricting attribute in the cylindrical hole different from the coaxial flared shape opening in the apparatus of Hamelin et al, Cain et al, Chinn et al and Metzner et al.

The motivation for providing a flow restricting attribute in the cylindrical opening different from the coaxial flared shape opening because of having a smaller diameter of the cylindrical hole compared to the diameter in the flared opening in the apparatus of Hamelin et al, Cain et al, Chinn et al and Metzner et al is to provide an optimal pressure difference across the distribution plate for uniform gas flow distribution.

Claims 32 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hamelin et al (US 2006/0134919) in view of Cain et al (US 5,439,524), Chinn et al (US 2003/0124848) and Metzner et al (US 6,454,860) as discussed in claims 24 – 31, 33, 35, 37 - 44, 46 and 48 above and further in view of White et al (US 2003/0066607).

Hamelin et al, Cain et al, Chinn et al and Metzner et al do not disclose:

Regarding claims 32, 34, 45 and 47, the diffuser plate is either polygonal or rectangular.

White et al discloses: a rectangular gas distribution plate 20 for distribution process gas in the chamber (Para 0040).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide a rectangular distribution plate for distribution process gas in the chamber in the apparatus of Hamelin et al, Cain et al, Chinn et al and Metzner et al as taught by White et al.

It would also have been obvious to one of ordinary skill in the art at the time the invention was made to provide a polygonal distribution plate for distribution process gas in the chamber in the apparatus of Hamelin et al, Cain et al, Chinn et al and Metzner et al.

The motivation for providing a rectangular distribution plate is provide a distribution plate of suitable geometry for gas distribution in the apparatus of Hamelin et al, Cain et al, Chinn et al and Metzner et al as taught by White et al.

The motivation for providing a polygonal distribution plate is again to provide a distribution plate of suitable geometry for gas distribution in the apparatus of Hamelin et al, Cain et al, Chinn et al and Metzner et al, which is an alternate and equivalent distribution plate. Furthermore It was held in *re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966) that the shape was a matter of choice which a person of ordinary skill in

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the art would have found obvious absent persuasive evidence that the particular shape was significant. (Also see MPEP 2144.04(d)).

Response to Arguments

Applicant's arguments filed 1/22/2008 have been fully considered but are persuasive.

The Examiner acknowledges the cancellation of claims 1 – 22.

Regarding the argument for amended claim 23, Hamelin et al does not teach a gas distribution plate assembly for a plasma deposition chamber including a diffuser plate having an upstream side and a downstream side in the plasma deposition chamber and an RF power source coupled to the diffuser plate.

A new reference of Cain et al has been used which reads on the amended claim language.

Regarding the arguments:

Claims 23-31 and 35 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Metzner et al (U.S. Patent No. 6,454,860). Applicant respectfully traverses the rejection.

The Examiner asserts that Metzner et al disclose a processing system (100) (Fig. 2) having a processing chamber (200) comprising a diffuser plate (240) (Fig. 4) having an upstream side and a downstream side and a plurality of gas passages (238) passing between the upstream and downstream sides, wherein at least one of the gas passages (Fig. 9) has a first cylindrical shape (269) for a portion of its length extending from the upstream side, a second coaxial cylindrical shape (286) with a smaller diameter (287) connected to the first cylindrical shape, a coaxial conical shape connected to the second cylindrical shape for the remaining length of the diffuser plate, with the upstream end of the conical portion having substantially the same diameter (287) as the second cylindrical

shape and the downstream end of the conical portion having a larger diameter (288). Applicant respectfully submits that the Examiner errs in this assertion.

Metzner et al teach a showerhead having a plurality of apertures extending from an upstream side to a downstream side of the showerhead. Each aperture has a first cylindrical section of constant diameter extending from the upstream side of the showerhead. Therebelow, the first cylindrical section tapers downwardly with a decreasing diameter to a second cylindrical section of a constant diameter, smaller than

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the diameter of the first section. The second cylindrical section extends downwardly and flares to a section of increasing diameter. Therebelow, a third cylindrical section of a constant diameter extends to the downstream side of the showerhead (Fig. 9). Metzner et al does not teach a coaxial conical shape connected to the second cylindrical shape for the remaining length of the diffuser plate.

The Examiner agrees and the rejection is made by combining the reference of Hamelin et al which discloses in Fig 9B, a plurality of gas passages passing between the upstream and downstream sides, wherein at least one of the gas passages has a first cylindrical shape for a portion of its length extending from the upstream side, a second coaxial cylindrical shape with a smaller diameter connected to the first cylindrical shape and extending for a portion of its length, a coaxial conical shape connected to the second cylindrical shape for the length of the remaining portion of the diffuser plate, with the upstream end of the conical shape portion having substantially the same diameter as the second cylindrical shape and the downstream end of the conical shape portion having a larger diameter.

Regarding the arguments: Claims 32 and 34 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Metzner et al (U.S. Patent No. 6,454,860) in view of White et al (U.S. Publ. No. 2003/0066607). Applicant respectfully traverses the rejection.

Metzner et al are discussed above with regard to claim 23. White et al do not remedy these deficiencies.

Therefore, Metzner et al and White et al, alone or in combination, do not teach, show, or suggest the gas distribution plate assembly of claim 23, wherein the diffuser plate is polygonal as recited in amended claim 32. Applicant requests withdrawal of this rejection.

Additionally, Metzner et al and White et al, alone or in combination, do not teach, show, or suggest the gas distribution plate assembly of claim 32, wherein the diffuser plate is rectangular as recited in claim 34. Applicant requests withdrawal of this rejection

The Examiner disagrees because of the following reasons:

White et al disclose a rectangular gas distribution plate 20 for distribution process gas in the chamber (Para 0040). Therefore, it would have been obvious to a skilled artisan to provide a rectangular distribution plate for distribution process gas in the chamber in the apparatus of Hamelin et al, Metzner et al and Cain et al as taught by White et al. It would also have been obvious to one of ordinary skill in the art at the time the invention was made to provide a polygonal distribution plate for distribution process gas in the chamber in the apparatus of Hamelin et al, Metzner et al and Cain et al. It was held in *re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966) that the shape was a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular shape was significant. (Also see MPEP 2144.04(d)).

Regarding the other arguments; it has already been discussed above since the claims are similar.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

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the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Satish Chandra whose telephone number is 571-272-3769. The examiner can normally be reached on 8 a.m. - 4:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, Primary Examiner, Jeffrie R. Lund can be reached on 571-272-1437. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jeffrie R. Lund/
Primary Examiner, Art Unit 1792

Satish Chandra

Jeffrie R. Lund
Primary Examiner

SC
2/27/2008

